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MOTOR VEHICLE SENSOR ARRANGEMENT FOR DETECTING AN ENVIRONMENT

The invention relates to a sensor arrangement for a motor vehicle for detecting an environment having at least one camera system.

A sensor system of this type can be used, for example, for assisting the driver, thus for supporting an operator of a vehicle. It supplies information on the environment and can be used in the domain of lane tracking, for a warning in the case of a lane deviation, or in the domain of automatic vehicle guiding.

In the case of such sensor systems, it is known to use so-called CCD cameras (CCD = charged coupled device). However, it should be taken into account that the functionality of driving assistance systems is limited when the sensor is already subjected to limitations when detecting the environment. In the case of CCD cameras, it is known that, especially in darkness and in the event of a blinding by an external light source, these cameras have a limited functionality. In this case, with respect to a blinding in darkness, a superproportional limitation should

be taken into account, specifically when the CCD camera is adjusted to the environmentally caused illumination level. In the event of encountering another vehicle driving with switched-on lights, the image information is even largely destroyed by the oncoming blinding sources.

The use of infrared cameras in such sensor arrangements is also known (compare technical journal: CAR AND DRIVER, October 1998). Infrared cameras take a heat image of the driving environment. In the heat image, all contours and objects are based on thermal contrasts. However, the information which is important for the driving task or for the reaction of a driver assistance system cannot always be obtained from the heat image.

It is an object of the present invention to further develop a sensor arrangement of the initially mentioned type such that a detection of the environment can take place essentially without any limitation of the functionality.

This object is achieved by means of the characteristics indicated in Claim 1.

An essential idea of the invention is to use at least two camera systems with respectively different spectral operating regions.

According to a preferred embodiment, the sensor arrangement comprises a CCD-camera (charged coupled device) and a camera which operates in the infrared range. The infrared camera represents, for example, a meaningful supplementation of the sensor system (CCD), which is visual here, beyond its detection limits in the extended area in front of the driving environment.

According to another advantageous embodiment of the invention, the different camera systems are equipped with different focal distances. For example, the infrared camera takes over the detection of the environment in the remote range because it is suitable for day and night and is free of any blinding. Freedom from blinding means in this context that the individual pixels are not overmodulated by the headlights of oncoming vehicles. The image information is therefore retained although the environment is completely dark. The close range is detected by the CCD camera. In particular, the latter is adjusted such that it operates in a range which, when the vehicle

lights are switched on, is illuminated by the front headlights. Because of the higher illumination level, this measure reduces the susceptibility of the CCD camera to blinding.

When using camera systems with different focal distances and the connected imaging scales, the driving environment can be detected better as a whole in the close and in the remote range.

Another advantage of using two camera systems with different spectral operating regions consists of determining the extinction of the atmosphere in the two spectral regions by means of differential contrast evaluation. By comparing the extinctions, conclusions can be drawn with respect to fog or haze, which has a different effect on the sensor range. Furthermore, in conjunction with a visual range model filed in a vehicle, a driver's visual range can be determined from the detected extinctions. This information, in turn, can be made available to the driver, or control parameters can be adjusted in the vehicle as a function of the determined driver's visual range.

These and other advantageous embodiments are defined in the subclaims.

The single figure will be explained in detail in the following and with reference to the single drawing. The figure of the single drawing is a schematic top view of a vehicle with a sensor system according to the invention arranged on the front.

A vehicle 10 has two headlights 12 which illuminate a certain light range L during the operation.

Between the two front headlights 12, two cameras are arranged, specifically in this case, an infrared camera 16 and a CCD camera (CCD = charged coupled device) 14. Both cameras 16 and 14 are aligned in the driving direction. The CCD camera is constructed and adjusted such that it essentially detects the range A which is illuminated when the front headlights are switched on and therefore corresponds to the range L.

In contrast, the infrared camera 16 detects the environment particularly in the remote range B.

Both cameras 16, 14 are connected with a control and analyzing device 18. The control and analyzing device 18 emits a

signal to a display 20 which is arranged in the vehicle interior in the driver's viewing range. The display 20 informs the driver of the environmental situation in the detected ranges.

In addition, but not shown in the figure, the control and analyzing device 18 can supply its information also to other units in the vehicle, for example, to systems which concern an automatic vehicle guidance.

On the one hand, the control and analyzing device 18 forwards the information transmitted by the cameras 16 and 14 directly to the driver. It also carries out a differential contrast evaluation. As a result, the extinctions of the atmosphere can be determined in the two spectral regions. If a visual range model is also filed in the control and analyzing device 18, by way of the determined extinctions and by means of a differential contrast evaluation, a conclusion can also be drawn with respect to the driver's visual range.

This visual range and/or these extinctions can then be utilized for adapting control parameters or for recommending a speed to the driver.

However, for determining the extinction in the visible spectral region, another system, such as a LIDAR system may also be used.